Atomic-Scale Sliding Friction on Graphene in Water

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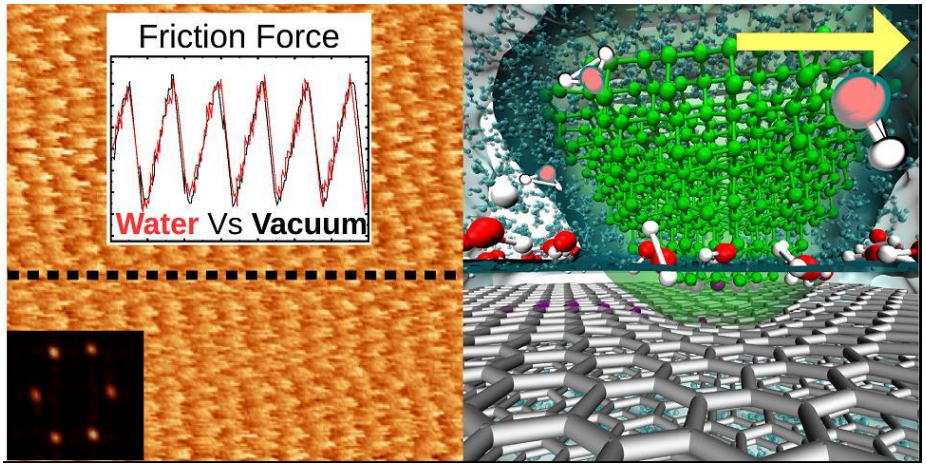
The sliding of a sharp nanotip on graphene completely immersed in water is investigated by molecular dynamics (MD) and atomic force microscopy. MD simulations predict that the atomic-scale stick-slip is almost identical to the one found in ultra-high vacuum. Furthermore, they show that water plays a purely stochastic role on sliding (solid-to-solid) friction. These observations are substantiated by friction measurements on graphene grown on Cu and Ni, where, oppositely to operation in air, lattice resolution is readily achieved. Our results not only promote friction force microscopy in water as a robust alternative to ultra-high vacuum measurements but also they suggest that friction measurements could unveil the subtle dynamical lateral order induced by a hydrophobic material like graphene on the water hydration layer.



References

[1] J. G. Vilhena, Carlos Pimentel, Patricia Pedraz, Feng Luo, Pedro A. Serena, Carlos Pina, Enrico Gnecco, and Rubén Pérez, ACS Nano, Article ASAP; DOI: 10.1021/acsnano.5b07825 (2016)